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Proceedings for the regional peer review of the Great Slave Lake stock assessment approach for sustainable fisheries development

April 25-26, 2013
Freshwater Institute
Winnipeg, MB

Chairperson: Kevin Hedges
Editor: Colin Charles

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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

A regional science peer review was held on April 25-26, 2013 in Winnipeg, Manitoba. The purpose of the meeting was to review a sampling protocol used in the Great Slave Lake multi-species fishery-independent survey. The survey is currently in year 2 of a 5-year plan to assess the population dynamics of targeted fishes within the commercial fishery. Topics of the discussion during the course of the meeting included reviews of three working papers, presentations regarding multi-species fish surveys and the quantitative stock assessment of Walleye (*Sander vitreus*) population dynamics in Lake Erie, and the draft Science Advisory Report (SAR). The SAR will provide researchers with sampling methods and collection procedures to use during a multi-species fishery-independent survey on Great Slave Lake. Participants included Fisheries and Oceans Canada (DFO) Science, Fisheries Management, and Aboriginal Aquatic Resource and Oceans Management, Environment Canada, Ontario Ministry of Natural Resources, Manitoba Water Stewardship, Aboriginal Affairs and Northern Development Canada and the University of Manitoba.

This Proceedings report summarizes the relevant discussions during the peer review and presents revisions to be made to the associated research documents. The SAR and the supporting Research Documents that result from this advisory meeting will be published on the DFO Canadian Science Advisory Secretariat website.

Compte rendu de l'examen régional par les pairs de la démarche d'évaluation des stocks du Grand lac des Esclaves pour le développement durable des pêches

SOMMAIRE

Un examen scientifique régional par les pairs a été réalisé les 25 et 26 avril 2013 à Winnipeg, au Manitoba. Le but de cette réunion était d'examiner le protocole d'échantillonnage utilisé dans le cadre du relevé plurispécifique indépendant de la pêche dans le Grand lac des Esclaves. Ce relevé en est actuellement à la deuxième année d'un plan de cinq ans visant l'évaluation de la dynamique des populations de certains poissons visés par la pêche commerciale. La réunion comprendra des discussions sur les trois documents de travail, les présentations concernant les relevés plurispécifiques, l'évaluation quantitative du stock de doré jaune (*Sander vitreus*) et de la dynamique des populations dans le lac Érié, et l'avis scientifique provisoire. L'avis scientifique fournira aux chercheurs des méthodes d'échantillonnage et des procédures de collecte à utiliser dans le cadre les relevés plurispécifiques indépendants de la pêche dans le Grand lac des Esclaves. Les participants comprennent le Secteur des sciences, la Gestion des pêches et le Programme autochtone de gestion des ressources aquatiques et océaniques de Pêches et Océans Canada (MPO), Environnement et Changement climatique Canada, le ministère des Richesses naturelles et des Forêts de l'Ontario, Gestion des ressources hydriques Manitoba, Affaires autochtones et du Nord Canada et l'Université du Manitoba.

Le présent compte rendu résume les discussions pertinentes menées durant l'examen par les pairs, et présente les modifications qui seront apportées aux documents de recherche connexes. L'avis scientifique et les documents de recherche complémentaires qui découlent de la présente réunion de consultation sont publiés sur le site Web du Secrétariat canadien de consultation scientifique du MPO.

INTRODUCTION

A commercial fishery for Lake Whitefish (*Coregonus clupeaformis*) has existed on Great Slave Lake since the mid-1940s (Read and Taptuna 2003). Commercial harvest has decreased significantly since the establishment of the fishery, leading to questions about the stability of the fish community and the sustainability of the Lake Whitefish population. Only recently have fishery managers initiated a logbook information collection program to acquire information about spatial fishing location and effort.

An integrated fisheries stock assessment was initiated on Great Slave Lake to determine the state of the fish stocks and evaluate harvest policies. To assess the fish populations in Great Slave Lake, the lake is being sampled by individual management areas over a 5-year period, with two reference areas sampled each year. Each management area is further divided by a series of grids, with grids to be sampled in a random order over the course of the survey. Catch information from this survey will be used to assess fish population production and the effects of cumulative impacts on the Great Slave Lake fish community.

A regional science peer review was held April 25-26, 2013 in Winnipeg, Manitoba to review the sampling protocol used in the Great Slave Lake multi-species fishery-independent survey following the meeting terms of reference (Appendix 1). Participants included Fisheries and Oceans Canada (DFO) Science, Fisheries Management, and Aboriginal Aquatic Resource and Oceans Management, Environment Canada, Ontario Ministry of Natural Resources, Manitoba Water Stewardship, Aboriginal Affairs and Northern Development Canada and the University of Manitoba (Appendix 2). The meeting followed the agenda outlined in Appendix 3.

This proceedings report summarizes the relevant discussions from the peer review and presents revisions to be made to the associated research documents. The three research documents provide the following information presented at the meeting:

1. Evaluation of capture efficiency and mesh-sized gillnet selectivity for important fishes in Great Slave Lake
2. Fishery-independent gillnet study (FIGS) sampling protocol used for multi-species study in Great Slave Lake
3. Comparison of otoliths, pectoral fin rays, and scales for estimating age, growth and mortality of Lake Whitefish

The Science Advisory Report (SAR) summarizes the current protocol for the multi-species survey and future plans for the assessment.

DETAILED DISCUSSION

WELCOME AND OPENING REMARKS

Presented by K. Hedges

After a round of introductions, participants were given a brief introduction to the meeting which included a summary of the protocol being examined for the multi-species fishery-independent survey on Great Slave Lake. The science advisory process was explained along with the goal of producing a Science Advisory Report, Proceedings and Research Documents from the meeting. The draft Research Documents formed the basis for discussion on the first day and participants were encouraged to add to or change the material, as needed, to ensure that the best and most up-to-date information was included.

DRAFT RESEARCH DOCUMENTS

Presented by X. Zhu

On the first day of the meeting, a presentation was given that focused on the following areas:

- Determining fishing effects on stocks
- Evaluating alternative harvest policies
- Discussing methods and models used in multi-species fisheries

Short and long term goals were introduced for the whitefish fishery as well as modeling approaches. Historical data from the fishery were presented, showing changes in catch over time. Discussion, questions and concerns that were raised are described below.

Commercial Fishery

Effort associated with the commercial fishery has varied throughout the fishery. Fish prices have not changed together with the rising cost of living; this has caused a decrease in fishing effort by commercial fishers. Lake Trout (*Salvelinus namaycush*) are not currently a targeted species, but they are by-catch in the Lake Whitefish fishery. A Lake Trout fishery has not existed in the western basin since 1985. Some fishers still pay for their licenses even though they don't fish, so that they can stay in the fishery, but this makes it difficult to obtain accurate effort data for the fishery. In the 1950s the fishery was essentially not regulated by a quota. Around 1970 the quota was lowered to maintain a sustainable fishery.

Currently, the fishery does harvest the entire lake-wide quota due to the division of the quota among fishing areas on the lake. The quota has had an effect on individual areas of the lake, but this is not reflected in the total catch.

Inflow from Slave River Graph

In the 1950s, discharges from the Slave River accounted for 2% of the inputs in winter (February) and 17% in summer (June). In the 2000s, these discharges changed to 7% in winter and 12% in summer. The summer and winter discharges from the Slave River were projected to be equal in 2028. This trend was used to determine how inflow from rivers has affected fundamental biological productivity and modified the availability of forage species and habitats for Lake Whitefish. An analysis of the relationship between monthly Slave River discharge and commercial Lake Whitefish harvest indicated that harvest decreased with increasing winter inflow with a 7 year lag. The Slave River is a critically important river, supplying terrestrially-derived nutrients to the lake. Great Slave Lake is oligotrophic, therefore the river fuels biological production and fisheries in the lake. Increased inflow in winter months may bring more nutrients into the lake as time continues, which may cause increased productivity, but it also presumably depresses the wintering habitats of Lake Whitefish. Decreasing Slave River discharge in summer will result in reduced nutrient inputs and lower fundamental biological production, leading to reduced prey supplies for predatory fishes. The 7-year lag effect can be inferred from the possible impact of reduced summer inflow on recruitment in the Lake Whitefish population. The data used in this analysis did not account for changes in fishing effort, only catch biomass, which caused some concern among participants because catch was not standardized. A suggestion was made to look at possible cyclical patterns of flow control in the Slave River and to implement a generalized linear least squares regression to look at variation around the means to observe biological linkages. There was consensus among participants to remove the flow versus catch graph from the SAR.

5 year survey plan

2012 represented year 2 of a 5 year survey plan for Great Slave Lake. Area 2 is to be surveyed in 2013 as well as two reference areas that will be surveyed each year to facilitate standardization.

Fishery-independent gillnet survey

Inconnu (*Stenodus leucichthys*) catches were not included in the presented biomass estimates; participants agreed that inconnu biomass should be included in future versions even though the total catch of inconnu was very low. During the survey, inconnu nets are used in most sampling grids (shallower than 40 m) and biomass is recorded.

Questions were raised about the mesh sizes of gillnets being deployed. There was a comment about how 4½" gill nets will probably c[illegible] the most biomass because fish caught in this net are market size. A variety of gillnets with different mesh sizes are deployed to obtain information on age structure, species composition and depth distributions throughout the lake. It was noted that some large fish can be caught in smaller mesh nets (probably due to getting their teeth caught, snarling, and entanglement).

Gillnet Selectivity

A graph was shown that compared catches between inconnu nets and standard gillnets. There was concern that including two different gears introduced a gear-selectivity bias into the model. A consensus was reached that each gear type should be modeled separately in the future to remove this potential bias.

Avoidance behaviours are displayed by fishes in different parts of the lake due to changes in turbidity. Day length affects avoidance because day length is so long during the summer months. Filament colour has a large impact on catchability, especially in the eastern arm of the lake.

One participant commented that the model seemed to be under-predicting biomass in a lot of cases and suggested using a delta-AIC approach to increase the quality of the model.

Age estimate comparison

Ageing techniques for fish were discussed in detail. Participants were shown the variability in estimating ages from three different ageing structures: otoliths, pectoral fin rays and scales. It was observed that scales seemed to be more accurate in younger fish, while otolith ageing was preferred for older fish. Participants commented that after age 8, scales did not perform as well as otoliths for ageing fish.

Participants agreed that otoliths provided the best age estimation, but no consensus was reached on the second best method. Participants agreed that further work needed to be done to increase the confidence of ageing using scales and fin rays.

General Comments

Recreational fisheries are only open in areas 5 and 6 in Great Slave Lake, and they represent a very small part of the total harvest. Historically, the aboriginal fishery was very large, but it is a small fishery now, although still of considerable importance to local communities.

Due to a lack of data for the Great Slave Lake fishery, one participant suggested removing recreational and aboriginal fisheries from the models and only using commercial fishery data. So far, the models that use these data seem to be incomplete and include a combination of

uncertainty and risk. Uncertainty and risk are different components; risk can be defined as having reasonable data while uncertainty occurs when data are not available and it is hard to consider uncertainty within a modeling framework. For future model implementation, the author should attempt to model risk and uncertainty separately.

LAKE ERIE STOCK ASSESSMENT SURVEY

Presented by A. Cook

Protocol

During the Lake Erie stock assessment survey, all Walleye (*Sander vitreus*) and Lake Whitefish that are caught during a multi-mesh gillnet survey are sampled, while only 40 Yellow Perch are sampled per net. Ages of Lake Whitefish are estimated using otoliths and scales. Fin rays are not used to age fish in this survey. Fish that are <50 cm in length are aged using scales while otoliths are used when fish are >50 cm in length. Otoliths are aged using the whole otolith method, in contrast to the crack and burn method (which is faster). One participant asked if they use a length to age relationship in this survey to predict age (fork length versus age), but they rely on otoliths and scales for accurate age estimates.

Lake Whitefish catches in this survey are uncommon, with catches being rarely observed in the western basin and most Lake Whitefish being caught in the central and eastern basins. Young-of-the-year (YOY) Lake Whitefish catches are even more uncommon, therefore they do not use the gillnet survey as a reliable indicator for YOY Lake Whitefish. In cases where Lake Whitefish are caught in the survey, most are caught in deep bottom nets (~20-25 m). The presenter noted that because Lake Erie is shared between Canada and the USA, the techniques used in surveys differ throughout the lake, which causes problems when calculating total abundances within the lake.

General Comments

Local quotas are set in the fisheries and usually do not constrain any of the licenses that are given out since only about 50 vessels are used in the fisheries. It is nearly impossible to target Lake Whitefish for assessment due to their low abundance in Lake Erie.

ASSESSMENT AND MANAGEMENT OF WALLEYE IN LAKE ERIE

Presented by Y. Zhao

Management Plan

The management of the Walleye stock in Lake Erie is based on Walleye aged 3-7+ years. Depending on the abundance of Walleye there are 5 management options used in the fishery to set quotas:

1) High
2) Maintenance
3) Low
4) Rehabilitation
5) Crisis

The quota is not based on age structure, but on the total available abundance within the fishery. Gear and landing restrictions in the U.S. and Canada limit the number of fish that are caught in each age class due to selection (gear selection and length selection). There are differences in the gear used in Canada and the U.S.; Canada is mostly a gillnet fishery while the U.S. is

mostly on existing fishery. Landings are ~10 times higher in Canada compared to the U.S. primarily because there is no commercial walleye fishery in the U.S.

The distributions used to represent target and bycatch species were discussed. ASMFC models typically use log-normal curves and other catch distributions have not been examined for the fishery.

One participant noted that the thresholds used to designate the five management options and therefore setting the quotas ignored auto-correlated trends in catch. Questions were raised as to whether incorporating autocorrelation into setting quotas had been discussed within the management group. Prior to 2005, there were no survey data on early models (1980s) relied on fishery data while more recently survey data are being incorporated into the models. Every five years they revisit their management plan to review the model being used and how it estimates abundance and survival. Maximum Sustainable Yield relies on stock recruitment relationships.

DISCUSSION OF THE SCIENCE ADVISORY REPORT (SAR)

1) Review of sampling protocol
2) Development of quantitative framework for assessing population productivity
3) Identify additional work

This section highlights the discussion about methods used in the Great Bear Lake stock assessment. No changes were made to the draft SAR as the time was used to develop ideas and to discuss possible changes to the proposed methods.

Sampling Protocol

The first item discussed was the sampling depths and the deployment of nets at different depths. It was agreed that a maximum of three nets would be set in each grid, with one net set in the thermocline. Since this is the first sampling design for the survey, the primary goal is to accumulate data that can be used to re-evaluate the survey design after 3-5 years. If nets deeper than ~40 m in recovery nets will not be set because nocomis are rarely found at that depth.

There were concerns about the large number of zeroes recorded in catches at some points in the lake (mostly in the middle). One participant remarked that fishers on Great Bear Lake rarely venture far from shore to set nets. There was concern that sampling only in the summer could lead to a large gap in data collection.

Sampling Sites

A random sampling protocol is followed throughout the field season, but sites can't be sampled in close proximity to each other because it might bias the assessment (seasonal bias). The survey includes random depth stratified sites, but there are also control sites that are sampled every year for comparison. Questions were raised about sampling near shore as sites which weather prevented vessels from venturing far from shore, but the consensus was that the survey should follow the random sampling protocol. Consensus was reached on the depth sampling and grid sampling protocols.

Net Size

Since multiple mesh sizes are used at each sampling site, questions were raised as to whether there would be multiple measures of catch per unit effort (CPUE) and how CPUE would be calculated. During the preliminary analysis CPUE will be standardized by the area of the nets and there will only be a single CPUE value per set. Consensus was reached on using the mesh sizes and geometric sequence of 1.31 for panel size described in the report. The sampling

[illegible] should be re-examined in 3-5 years, as soon as sufficient data have been gathered. A reassessment of the sampling design needs to be changed.

For future sampling it is suggested that no larger rat-ice sized because they are good swimmers and can avoid the cooperation can that is currently taking used. It was suggested that future may need to be sampled at night when they are in the water column and not on the bottom.

Environmental Measurements

A vessel data measures will all be implemented to measure water clarity as well as water colour in each grid. No UV measurements will be added to the survey protocol.

Sub-sampling Fish

Consensus was reached to following the fish collection protocol as outlined in table 4 of the global study sampling protocol currently used. It was not will be added to the sampling form in second position for have any observable scars or deformities.

Biological Sampler / Ageing

Biological sampling was discussed a week in the section will the focus on ageing structures. Small fragments of pectoral fin rays are used for DNA analysis, but the remaining ray will also be used for ageing. There a greater precision will no rays than scales, but there is more bias when compared to otoliths.

For the ageing technique comparison study, the description of the methods used to read the different structures and the study design need to be stated. The person reads one type of ageing structure (otolith, scales or fin rays) from every fish three times (not each read three times). Each person was considered a specialist for reading their assigned structure and the estimates were used to examine differences in ageing among the structures.

Consensus was reached that otoliths should be the primary ageing structure. The survey will still collect all three structures and the second best ageing structure will be determined at a later time.

Capacity, Establishment (Bird)

Logbook Data

Commercial logbook data are currently being collected on Ocean Stars Labs. The data entries include: discards (in kind and in mass), time sampled and GPS coordinates. Logbooks are now mandatory for farmers.

Changes to Sampling Order

Discussions were held regarding the sampling order if bad weather prevented the sampling of all strata sites. During bad weather when boats cannot go out to UK strata sites, is it ok to sample in bad strata area without bias and change the order of the grid sampling or would this bias the results for fish being caught near shore? The consensus was that sampling needed to follow the randomised sampling protocol and should not be adjusted to accommodate weather.

Stock Discharge

The effect of over discharge on catch rates can still be examined, but it should be more of a secondary objective. Remote sensing signals cannot be used, ground truthing data are needed to calculate chlorophyll, suspended sediments and salinity. Any data that can be collected can be used to inform decisions regarding impacts on Ocean Stars Labs from dams down river of

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1. [illegible]
2. [illegible]
3. [illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]

Participation

- Fisheries and Oceans Canada (DFO) (Science, and Fisheries and Aquaculture Management)
- Environment Canada
- Great Slave Lake Advisory Committee (GSLAC)
- Manitoba Water Stewardship
- Ontario Ministry of Natural Resources
- University of Manitoba
- Other invited experts

APPENDIX 2: LIST OF PARTICIPANTS

Name	Affiliation
Therese Carmichael	Fisheries and Oceans Canada - Science
Colin Charles	Fisheries and Oceans Canada - Science
Andy Cook	Ontario Ministry of Natural Resources
Patti Dodo	Aboriginal Affairs and Northern Development Canada
Marlene Evans	Environment Canada
Colin Gallagher	Fisheries and Oceans Canada - Science
Darren Gillis	University of Manitoba
Kevin Hedges (Chair)	Fisheries and Oceans Canada - Science
Deanna Leonard	Fisheries and Oceans Canada - Fisheries Management
George Low	Aboriginal Aquatic Resource and Oceans Management
Chelsey Lumb	Manitoba Water Stewardship
Jenjua Muhammad	Fisheries and Oceans Canada - Science
Ross Tallman	Fisheries and Oceans Canada - Science
Melanie VanGerwen-Toyne	Fisheries and Oceans Canada - Science
Yingming Zhao	Ontario Ministry of Natural Resources
Xinhua Zhu	Fisheries and Oceans Canada - Science

APPENDIX 3. AGENDA

Regional Peer Review for the Great Slave Lake Fishery Protocol – Sample Collection, Fish Survey and Science Advisory Report

Day 1: 25 April 2013, from 8:30 a.m. to 5:00 p.m. (Central Daylight Time)

Freshwater Institute, Winnipeg, MB

8:30 Introductions (round table)

8:40 Welcome and opening remarks by Kevin Hedges

8:50 Introductions, review of agenda, RAP process explanation, responsibilities of participants and comments from participants.

9:00 Xinhua Zhu presentation review of the draft research documents (i.e., the working paper)

10:15 Coffee Break

10:45 Invited talk – Andy Cook presentation, review of Lake Erie stock assessment procedures

11:50 Lunch

13:00 Invited talk – Yingming Zhao presentation, Assessment and Management of Walleye Population in Lake Erie

14:00 SAR – Sampling Protocol

14:30 SAR – Grid Sampling

15:30 Coffee break

15:45 SAR – Sub- Sampling Fish

16:00 SAR – Biological Sampling

16:45 Meeting adjourns

Day 2: 26 April 0013, from 8:30 a.m. to 11:30 a.m. (Central Daylight Time)

Freshwater Institute, Winnipeg, MB

8:30 Introductions (round table)

8:45 Begin Review of the Science Advisory Report (SAR)

9:00 Title, Images and Context sections

9:30 Summary

10:00 Review Frequency

10:15 Conclusions/Sources of Uncertainty

10:30 Coffee Break (Some members leave to catch their flights)

11:50 Concluding remarks about sources of uncertainty and general layout of SAR

11:30 Meeting Adjourned